

PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) IMPROVEMENTS RELATING TO A ROLLER MILL

(71) We, POLYSIUS AG, of Graf-Galen-Strasse, 17, Neubeckum 4723, Germany, a German Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a roller mill, especially a spring roller mill, with a grinding zone and a separating zone disposed above the grinding zone, the grinding zone containing a grinding surface together with roller bodies, in particular spring rollers, movable relative to the grinding surface, and a ring of guide vanes in the vicinity of the outer periphery of the grinding surface for directing an air stream which conveys the ground material from the grinding surface periphery into a separating space of the separating zone, the separating zone containing a rotatable fan whereby coarse material in the separating space is again fed back to the grinding zone, while the fine material is removed from the separating space with the air stream.

Roller mills of the type described are known wherein a static separating zone without rotating parts is disposed above the grinding zone. Immediately below the ring of guide vanes, which conveys the material-laden air into the separating space, there is a hopper portion which feeds coarse material back into the grinding zone. These static separating zones have however a relatively poor discrimination.

A roller mill of the type described has therefore also been developed wherein a separating zone with a rotatable fan is disposed above the grinding zone. In this case the grinding zone passes directly into the separating space without any demarcation. The coarse material in the separating space then falls back on to the outer area of the grinding surface, and is repeatedly entrained

by the incoming air stream before it is subjected to further crushing. The stream of separating air is thus subjected to undesired loading with coarse material, which results in poor utilisation of the mill. A further disadvantage is that where the spring rollers are used which project into the separating space, rotation thereof about the mill axis disturbs the separating process.

The object of the invention is therefore to construct a roller mill of the type described which ensures both effective utilisation of the mill and also high discrimination in separation.

According to the invention this object is achieved in that between the grinding zone and the separating zone there is disposed a further ring of guide vanes for feeding the air stream laden with the ground material into the separating space, together with a hopper disposed below said further ring of guide vanes for returning the coarse material to the centre of the grinding surface.

In the roller mill according to the invention, the separating air drawn in through the ring of guide vanes adjacent the grinding surface and then entraining the ground material is fed through the further ring of guide vanes into the actual separating space. Since there are no structures in this separating space to obstruct the stream of separating air, the fan prevents a sharp separation of coarse and fine material. Due to the return of the coarse material deposited in the separating space to the centre of the grinding surface by means of the hopper disposed below the further ring of guide vanes, there is a further grinding of the coarse material particles before they are again entrained by the air stream. In this way the undesired loading of the separating air stream with repeatedly deposited coarse material, referred to previously, is avoided, and this increases the output of the grinding zone and the separating zone.

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The said hopper also acts as a replacement body which prevents excessive drop in speed over the grinding zone, and thus favours pneumatic transport of the ground material.

5 In a roller mill in accordance with the invention it is also desirable for a material feed channel to be provided above the grinding zone, passing through the well of said hopper and terminating above an outlet of 10 the hopper. With this construction the coarse material to be returned reaches the grinding surface equally with the freshly supplied grinding material.

These and further details of the invention 15 will appear from the following description of an embodiment shown in the drawing. This drawing shows a spring roller mill, in the housing 1 of which there is provided a grinding zone 2 with a separating zone 3 disposed 20 above the grinding zone 2.

The grinding zone 2 contains a grinding surface consisting of a rotary grinding ring 4 and a centrally disposed distributor cone 5. The grinding zone 2 also contains spring 25 rollers 6, firmly held in supports (not shown) and freely rotatable about their axes 7. As a result of frictional drive by the grinding ring 4, the rollers 6 execute a movement relative to the grinding ring 4. The grinding ring 4 is driven by gearing 8, which is connected to a motor (not shown).

In the area of the outer periphery of the grinding ring 4 there is disposed between said ring and the mill housing 1 a ring of 35 guide vanes 9 whose air inlet side 9' is connected to an air feed channel 10.

The separating zone 3 contains a separating space 11, in whose upper part is disposed a rotatable fan 12. This fan 12 is affixed 40 to a shaft 13, driven at a controllable speed. Sprung centering arms 14, which can be adjusted externally, are provided in the upper separating zone for radially adjustable support of the shaft 13. The shaft 13 and its 45 bearing 23 are also surrounded by a fixed tube 15. At its end located outside the separating zone 3 this tube 15 has a branch pipe 16, through which can enter cooling air for the shaft 13. The other end of the tube 50 15 terminates in the separating zone 3. The upper part of the separating zone 3 is constituted by a conical cover 17 which leads to an outlet pipe 18 for air and fine material. The shaft 13 and the tube 15 pass through 55 this cover 17 from above. The shaft 13 and the tube 15 are also supported externally on the cover 17.

Between the downwardly tapering separating space 11 of the separating zone 3 and the 60 grinding zone there is provided a further ring of guide vanes 19, with a hopper 20 disposed beneath, having a hopper outlet 20' merging with an outlet pipe 21 terminating above the distributor cone 5. Above the grinding zone 65 2 there is also provided a material feed

channel 22, which may for instance be formed as a pneumatic or a vibrator feed channel. This feed channel 22 passes through the wall of the hopper 19 and terminates above the hopper outlet 20.

The material to be ground (arrow 24) is fed by the feed channel 22 into the roller mill. It passes through the hopper outlet 20' and the outlet pipe 21 on to the distributor cone 5, which feeds it with approximately uniform distribution to the grinding ring 4 driven by the drive 8. Here it is engaged by the spring rollers 6, rotating about their axes 7, and is ground. The ground material (arrow 25) is removed from the 80

grinding zone over the peripheral edge of the grinding ring 4. This ground material is now entrained by a stream of separating air (arrow 26) entering the mill through the channel 10 and the ring of guide vanes 9, 85

and this air feeds the material through the further ring of guide vanes 19 into the separating space 11. Separation of fine and coarse material takes place in this separating space 90

11; it is not hindered by any structures and is aided by the rotating fan 12, so that there is a sharp division of the ground material (arrow 25) into coarse and fine fractions. The fineness can be adjusted to requirements by varying the speed of the fan 12. The coarse material (arrow 27) is fed along the inner 95

wall of the separating space 11, the hopper 20, the outlet 20' and the outlet pipe 21, back to the distributor cone 5 which forms the 100

centre of the grinding surface, and which then feeds it together with the freshly fed material (arrow 24) on to the grinding ring 4. This ensures further grinding of the coarse 105

particles of material, before they are again entrained by the air stream (arrow 26). This type of intensive grinding prevents the separating air stream from being loaded with 110

repeatedly deposited coarse material. This results in an increased output from the grinding zone and the separating zone.

As will be seen from the drawing, the diameter D_1 of the cover 17 is smaller than the diameter D_2 of the upper part of the housing 1. Turbulence is thus caused in the area of the fan 12, and this very effectively 115 deposits any residual coarse material.

The fine material (arrows 28) together with the air stream (arrow 26) is removed from the separating zone 3 via the cover 17 and the outlet pipe 18. The material can then be separated from the air stream in a 120 separator device disposed outside the mill and not shown.

This separation may however also take place inside the mill housing. In this case the separating space 11 is connected, via a flow chamber located within the mill housing, to the inlet side 9' of the ring of guide vanes 9 provided at the outer periphery of the grinding surface, the separator device 125 130

being disposed in the flow chamber.

In order to prevent excessive heating of the shaft 13 and its bearing 23, the space 29 between the shaft 13 and its surrounding pipe 15 is connected to the atmosphere via the branch pipe 16, and also terminates in the separating zone 3. The flow of air in the separating zone 3 causes a reduced pressure in the space 29, which ensures a constant supply of cooling air to the shaft 13 and its bearing 23.

Finally, the shaft carrying the fan 12 can also be formed as a hollow shaft, extending with its lower end above the hopper outlet 15 20', so that it can act as a central grinding material feed pipe, which then makes the feed channel 22 unnecessary.

WHAT WE CLAIM IS:—

- 20 1. A roller mill with a grinding zone and a separating zone disposed above the grinding zone, the grinding zone containing a grinding surface together with roller bodies movable relative to the grinding surface and 25 a ring of guide vanes in the vicinity of the outer periphery of the grinding surface for directing an air stream which conveys the ground material from the grinding surface periphery into a separating space of the 30 separating zone, the separating zone containing a rotatable fan whereby coarse material in the separating space is again fed back to the grinding zone, while fine material is removed from the separating space with 35 the air stream, characterised in that between the grinding zone and the separating zone there is disposed a further ring of guide vanes for feeding the air stream laden with the ground material into the separating 40 space, together with a hopper disposed below said further ring of guide vanes for returning the coarse material to the centre of the grinding surface.
- 45 2. A roller mill as claimed in Claim 1, characterised in that above the grinding zone there is provided a material feed channel which passes through the wall of said hopper and terminates above an outlet of the hopper.

3. A roller mill as claimed in Claim 1, or 50 Claim 2, characterised in that said hopper is provided with a central grinding material feed pipe formed as a hollow shaft which terminates above the centre of the grinding surface.

55 4. A roller mill as claimed in any preceding Claim, characterised in that the separating zone has externally adjustable sprung centering arms for radially adjustable support of a shaft of the rotatable fan. 60

5. A roller mill as claimed in Claim 1, characterised in that the fan shaft and its bearing are enclosed by a fixed tube, and a space through which cooling air may flow, between said shaft and the tube, is connected 65 to the atmosphere through a branch pipe and also terminates in the separating zone.

6. A roller mill as claimed in any preceding Claim, characterised in that the grinding surface comprises a rotatable grinding ring 70 and a centrally disposed distributor cone.

7. A roller mill as claimed in any preceding Claim, characterised in that a common outlet pipe for air and fine material is disposed above the separating zone. 75

8. A roller mill as in Claim 1, characterised in that the separating zone is connected, via a flow chamber located within the mill housing, to the inlet side of the ring of guide vanes provided at the outer periphery of the 80 grinding surface.

9. A roller mill as in Claim 7, characterised in that the diameter (D_1) of an extension of the outlet pipe is less than the diameter (D_2) of the separating zone. 85

10. A roller mill substantially as herein described with reference to, and as shown in, the accompanying drawings.

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1,280,062 COMPLETE SPECIFICATION

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*This drawing is a reproduction of
the Original on a reduced scale.*

